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ABSTRACT

The Brazelton Neonatal Behavioral Assessment Scale (BNBAS) was administered to a group of 73 premature infants at approximately 34, 36, and 40 weeks of gestational age. Six behavioral cluster scores and one reflex cluster score were computed for each examination. Repeated measures analyses of variance showed significant steady improvement on all clusters over time. Profile analyses based on individual patterns of behavior over the three exams also indicated that steady improvement was the most common pattern. Intraclass correlations (generalizability coefficients) computed on these data, however, ranged from .026 to .623, indicating only low to moderate stability in the relative status of these infants over the time period studied. (Author/MP)

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Stability and Change in the Behavioral Development of Premature Infants

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The Brazelton Neonatal Behavioral Assessment Scale (BNBAS) was administered to a group of 73 premature infants at approximately 34, 36, and 40 weeks of gestational age. Six behavioral cluster scores and one reflex cluster score were computed for each examination. Repeated measures analyses of variance showed significant steady improvement on all clusters over time. Profile analyses based on individual patterns of behavior over the three exams also indicated that steady improvement was the most common pattern. Intraclass correlations (generalizability coefficients) computed on these data, however, ranged from .026 to .623, indicating only low to moderate stability in the relative status of these infants over the time period studied.

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The appearance of the Brazelton Neonatal Behavioral Assessment Scale (BNBAS) (Brazelton, 1973) has facilitated research in many areas of infant development. Even though behavioral changes in normal infants over the first month of life have been described (Als, Tronick, Lester, & Brazelton, 1977), there has been no corresponding study of the behavioral development of premature infants. Since premature infants are generally considered to be "at risk" for a variety of medical and psychological disorders, knowledge of the normal course of development for these infants is important to both parents and professional caregivers.

Method

Subjects

The 73 infants in this report were part of a longitudinal study of the development of premature infants (Barnard, Wenner, Weber, Gray, & Peterson, 1977). Participants in the study were selected from among those infants cared for in the intensive care nursery at University Hospital in Seattle, Washington, between 1975 and 1977, whose gestational age at birth was less

than 34 weeks, and who showed none of the following: (a) diagnosed major central nervous system disorder, (b) late pregnancy maternal drug addiction, (c) recognized chromosomal disorder, or (d) respiratory treatment requiring assisted ventilation after two weeks. The average gestational age for the infants in the study was 31.2 weeks (range of 27 to 34 weeks), and the average birthweight was 1368 g (range of 630 g to 2340 g). The health status of the infants varied considerably, although it can be said on the basis of the attending physicians' notes that about twice as many of the babies were "sick" as were "healthy." The larger study included some experimental manipulations of the physical environment, but since there were only a few scattered differences between experimental groups on the BNBAS, this paper will deal only with changes over time for the entire sample.

Procedure

Infants were examined with the Brazelton Neonatal Behavioral Assessment Scale (BNBAS) (Brazelton, 1973) on three occasions. The first examination was done when the infant reached 34 weeks of gestational age. At this time the average living age of the infants was 20 days (range 4 to 51 days) and the average weight was 1531 g(range 860 to 2200 g). Seventy-six per cent of the infants were being cared for in isolettes at the time of this first observation.

The second examination was done after the infant had been transferred to an open crib. This occurred when the babies were, on the average, 33 days old and when they weighed 1730 g (range 1350 to 2610 g). The final exam was done in the infant's home, approximately one month after hospital discharge. At the time of this exam, the infants averaged 66 days of living age (range 37 to 99 days) and 3041 g of weight (range 2268 to 4200 g).

All examinations were carried out in the standard manner, with two exceptions. First, additional items were added to the scale to try to

capture unique aspects of the behavior of premature infants. Those supplementary items have been described elsewhere (Kang & Barnard, 1979; Telzrow, Kang, Mitchell, Ashworth, Barnard, Reference note 1) and will not be discussed here. Second, each reflex item was scored separately for the right and left sides of the infant's body. Further, scores were given both for the performance of the reflex and for the threshold of its appearance. Consequently, 76 rather than 18 reflex scores were available for these infants on each exam.

All examinations were done by two examiners, one of whom had been checked for reliability of administration and scoring by Dr. Brazelton and his associates. Both examiners regularly tested healthy term babies as well as prematures, and their interobserver agreement on scoring exceeded .85 for both term and preterm infants.

Data Analysis

The data from the 27 behavioral items were used to compute cluster scores as suggested by Lester, Als, & Brazelton (Reference note 2). This method yields cluster scores for Habituation, Orientation, Motor Performance, Range of State, Regulation of State, and Autonomic Regulation. A Reflex cluster score was computed by counting the number of abnormal reflex items, which for this sample of infants, could range from 0 to 76. The means on this cluster, then, cannot be directly compared to those computed using the method described by Lester and his colleagues.

Results

Reliability of Cluster Scores

Although the reliability of the BNBAS has customarily been reported in terms of interobserver agreement on scoring (e.g., Sameroff, 1978), the more appropriate measure for the present study is the internal consistency of the cluster scores. Consequently, Cronbach's Alpha was computed for each cluster at each exam,

and these coefficients are shown in Table 1. They range in magnitude from

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Insert Table 1 about here
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.245 (Regulation of State on exam 2) to .900 (Orientation on exam 3). Certainly one reason for their modest size is the relatively small number of items in each cluster, and this view is supported by the fact that the clusters with the largest number of items (6 in Orientation, 18 in Reflexes) also have the highest reliability coefficients.

Developmental Patterns

In order to study the individual patterns of change over time in these infants, cluster scores were rounded to the nearest whole number, and then a developmental profile description was assigned to each subject for each cluster. The five possible recovery profile descriptions were increasing (first score lowest, third score highest, second score intermediate or equal to first or third), decreasing (first score highest, third score lowest, second score intermediate or equal to first or third), peak (second score highest), and valley (second score lowest, and level (all three scores equal).

The distribution of these developmental profile types for each cluster is shown in Table 2. It is clear that the modal pattern for all clusters

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is for behavior to move in the optimal direction. That is, scores increase on Habituation, Orientation, Motor Performance, Range of State, and Regulation of State, and they decrease on Autonomic Regulation and Reflexes.

This finding is supported when we examine the mean scores on each cluster for each exam, which are shown in Table 3. Repeated measures

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Insert Table 3 about here

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analyses of variance were performed for each cluster, with exam occasion (which can be thought of as a factor measuring infant age) as the repeated measure. Age differences were significant beyond the .01 level for all clusters and without exception, the direction of change was in the optimal direction.

From these repeated measures analyses of variance, it was also possible to compute generalizability coefficients (Cronbach, Gleser, Nanda, & Rajaratnam, 1972; Mitchell, 1979). In this case, these coefficients represent the stability of the scores across different exam occasions (what Mitchell, 1979, called "developmental generalizability"). These coefficients are also shown in Table 3. They range in magnitude from .026 (Motor Performance) to .632 (Autonomic Regulation), indicating only low to moderate stability in the relative status of these infants over the time period studied.

Discussion

As expected, the premature infants in this study showed steady "improvement" over the course of the first month of life. That is, their behavior became increasingly similar to the behavior of healthy term infants for whom the BNBAS was designed. (This is not to say their behavior is identical to that of term infants; see Telzrow et al, Reference note 1). Moreover, this relationship holds whether the data are analyzed according to individual cases (in the profile analyses) or according to the group (the analyses of variance).

These results make it clear that it would be an error to judge the behavior of a young premature infant by standards appropriate for healthy term infants. Those working with such infants will need tools designed for

and standardized upon prematures, taking into account both gestational age and health status, in order to make reasonable developmental diagnoses.

Furthermore, it is clear that development during this period is not steady, and that early scores on the BNBAS are not good predictors of later scores. Further research may uncover the influences of variables such as health status, caregiving practices, or environmental variation in determining these idiosyncratic changes, but until such data are available, the BNBAS should be viewed as an indicator of current status, and not as a predictor of later behavior.

Reference Notes

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Footnote

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Table 1

Internal Consistency of BNBAS Cluster Scores

for Seventy-three Premature Infants

Cluster	Exam 1	Exam 2	Exam 3
Habituation	.502	.503	.371
Orientation	.897	.853	.900
Motor performance	.638	.317	.318
Range of state	.617	.598	.402
Regulation of state	x	.245	.456
Autonomic regulation	.280	.362	.482
Reflexes	.865	.789	.887

Table 2

Developmental Profile Aanlyses of BNBAS Cluster Scores for Premature Infants[a]

Cluster	Increasing	Decreasing	Peak	Valley	Level
Habituation	37	27	16	13	7
Orientation	63	7	19	8	3
Motor performance	84	2	10	2	2
Range of state	42	16	11	20	11
Regulation of state	55	11	22	6	6
Autonomic regulation[b]	19	40	16	11	14
Reflexes[b]	12	36	35	17	0

[a]Figures are percentage of infants showing each profile type.

[b]Lower score is optimal.

Table 3

Mean Scores on BNBAS Cluster Scores for Premature Infants

Cluster	Exam 1 34 weeks[a]	Exam 2 36 weeks[a]	Exam 3 40 weeks[a]	Generalizability Coefficients[b]
Habituation	5.70	6.27	6.49	.246
Orientation	3.84	5.10	5.72	.320
Motor performance	3.18	4.79	5.93	.026
Range of state	2.78	3.20	3.74	.446
Regulation of state	3.40	4.32	4.63	.328
Autonomic regulation[c]	5.57	5.44	5.07	.632
Reflexes[c]	48.90	47.81	43.08	.407

[a]Approximate gestational age.

[b]Intraclass correlation across exams.

[c]Lower score is optimal.